PMM-2
Multi-function Measuring Instrument

Megger

- **Integrated onboard LCD touch-screen display**
- **Multi-colored graphics with intuitive navigation**
- **Built-in report generator**
- **Portable battery-operated instrument**
- **Measure and display up to four voltages and four currents simultaneously or up to eight currents**
- **Accurate phase angle measurements at low current levels**
- **High-speed sampling and data recording**
- **Built-in timer and event logging**

DESCRIPTION

The Power MultiMeter, PMM-2 is the next generation multifunction instrument for measuring AC or DC voltage and current, primary, and secondary voltage and current, power, reactive power, power factor, phase angle and frequency of a single-phase or three-phase electrical system.

In the single-phase mode, the PMM-2 is easily configured to measure the amplitude and phase angle between any two voltage and current inputs. These measured quantities are then displayed in an enlarged font size for easier reading on a graphic display. In three-phase mode, all measured quantities are displayed simultaneously on a large, easy-to-read graphic display.

The unique software in the PMM-2, combined with a built-in, microprocessor-based timer, is specifically designed to ease testing and commissioning of protective relay systems, including induction unit pickup and timing tests.

The internal timer responds to a variety of start and stop gates, including the application of ac or dc voltage, and opening or closing of dry contacts.

The PMM-2 is a menu-driven instrument equipped with data-retention capabilities. It can be used to automatically store measured data using a user defined trigger. With a sampling rate of 28.8 k samples/second, and with 64 GB of memory, over 60 minutes of data can be stored on-board in non-volatile memory. The date and time can also be set, which can be used to start and stop data logging.

Accurate phase angle measurement at very low current levels, which can be displayed either as lagging or leading angles, is another feature of the PMM-2. The user can choose phase angle readings to be displayed as 0 - 360 degrees (leading or lagging) or ± 180 degrees.

Any current or voltage transformer ratio up to a ratio of 9999:1 or 9999:5 can be input into the instrument. The displayed value on the PMM-2 is the primary line value of the circuit under test. The values measured will be displayed as primary values eliminating the need for making conversions.

Available in the standard PMM-2 or rugged PMM-2R models.

APPLICATIONS

The PMM-2 is an ideal instrument for use in general electrical systems maintenance, electrical machine repairs, protective relay testing or in monitoring power at the electrical service entrance. Motor starting currents, voltages, and power can be captured for analysis.

The PMM-2 is designed to perform fast, accurate checking and testing of protective relay and meter installations during commissioning and in routine maintenance.

During meter installations the instrument can be configured to measure phase-to-phase voltage, single-phase current amplitudes, and phase angles.

The PMM-2 can be combined with a voltage or current source for test and calibration of virtually any type of protective relay.

DESCRIPTION OF OPERATION

The onboard touch screen display allows the user to selectively measure true rms voltage and current, phase angles and frequency. The PMM-2 software has been designed as a visually impactful user-friendly interface.

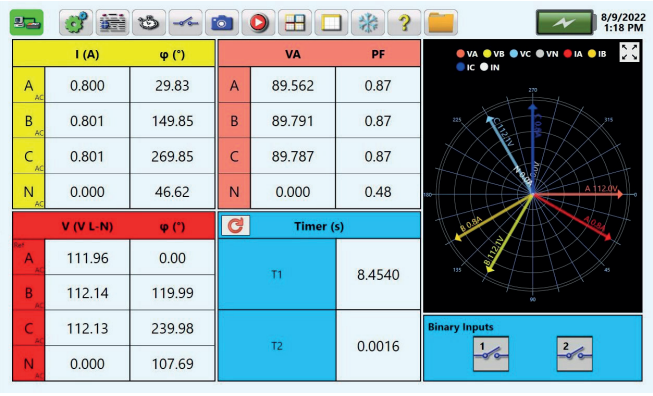

Figure 1: User interface showing three phase inputs with metered neutrals

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The most significant feature of the PMM-2 software is its ability to provide the user with a very simple way to measure voltage, current and phase angle quantities, for both commissioning and maintenance of substations and meter installations. Enhanced graphics, intuitive menu screens, and touch screen icon buttons are provided to select the desired meter function quickly and easily.

SYSTEM CONFIGURATION SCREEN

In the configuration screen the user can customise the nomenclatures for what and how quantities are displayed. Labels can be assigned for phase angles such as ABC, RST, XYZ, or 123. Languages can be selected based on user preference.

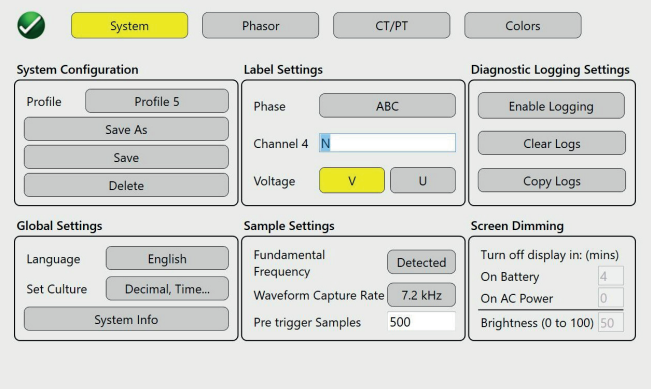

Figure 2: Configuration screen

A vector graph (shown in Figure 1) indicates the relative phase angles of all the measured quantities. The user can choose phase angle readings to be displayed in clockwise or counter-clockwise rotation, 0 - 360 degrees (leading or lagging) or ± 180 degrees. The user can even select where the 0° X-Axis is shown, see Figure 3.

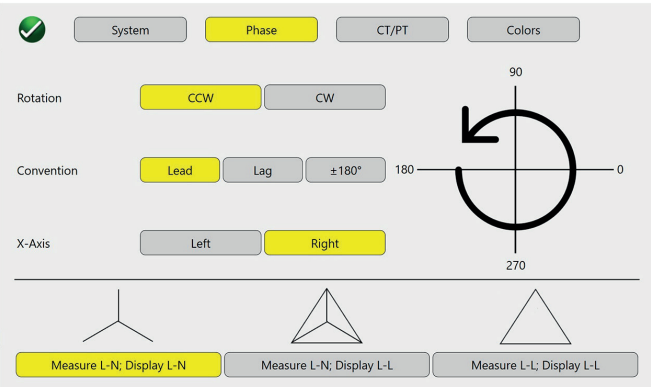

Figure 3: Phase angle display settings

In addition to the polar plot, the user may select specific waveform views. The combined waveform chart will display all waveforms together and the split waveform chart will display the voltages and currents separately.

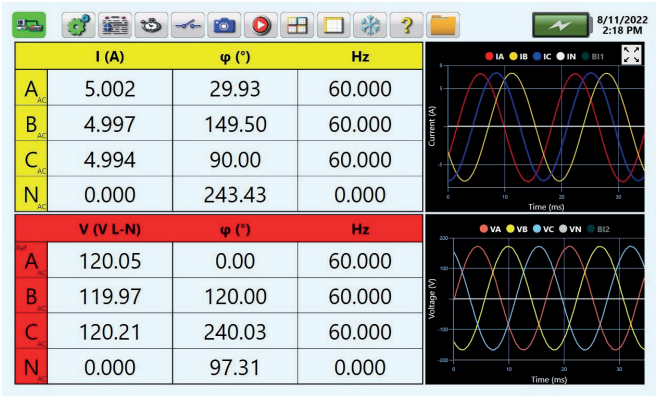

Figure 4: Split voltage/current waveforms screen

A chart and date table are displayed when measuring harmonics that will show the order of harmonic and amplitudes up to the 50th harmonic.

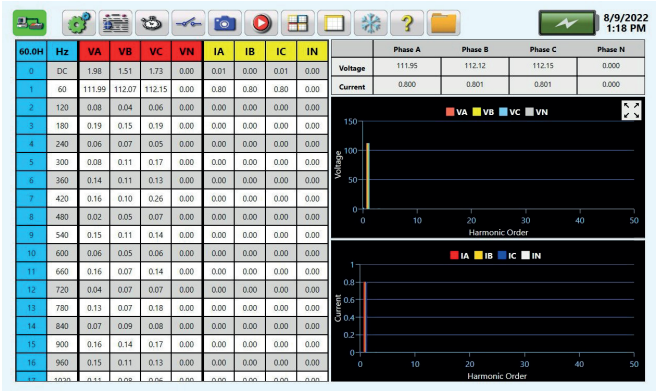

Figure 5: Harmonics table and graphic screen

When using clamp-on CTs, metered values can be viewed as either primary or secondary values. The user can set the ratios of the CTs and/or PTs using either ANSI or IEC models, see Figure 6.

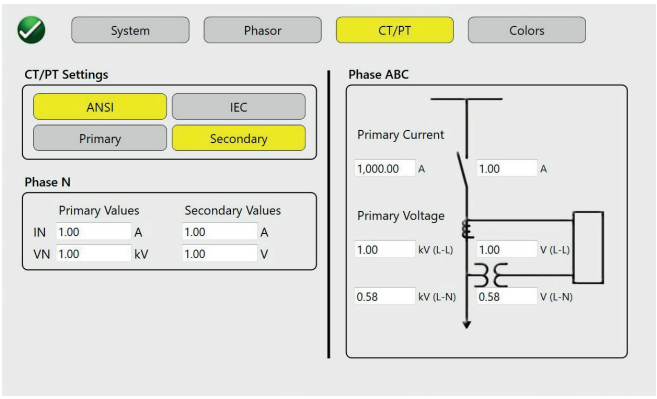

Figure 6: ANSI model for setting CT/PT ratios

After entering the ratio(s), the main screen display will be in primary values for example, kV, kA, kW kVAr, and kVA, see the example in Figure 7.

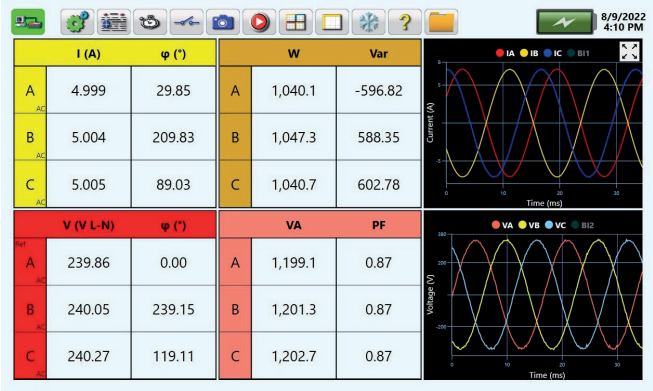

Figure 7: Example of primary values display

The colors for the voltage, current waveforms and phasors can be defined using the colors configuration screen. The user can modify the background, grid, and label colors, see the example in Figure 8.

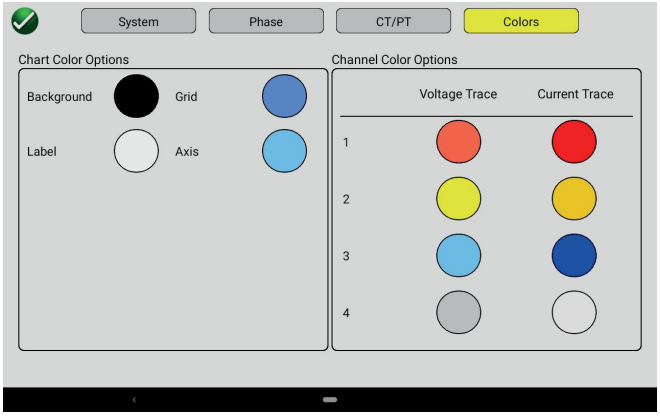

Figure 8: Colors setting screen

MAIN USER INTERFACE SCREEN

The main user interface screen can display a variety of optional user selected information regarding the measured values.

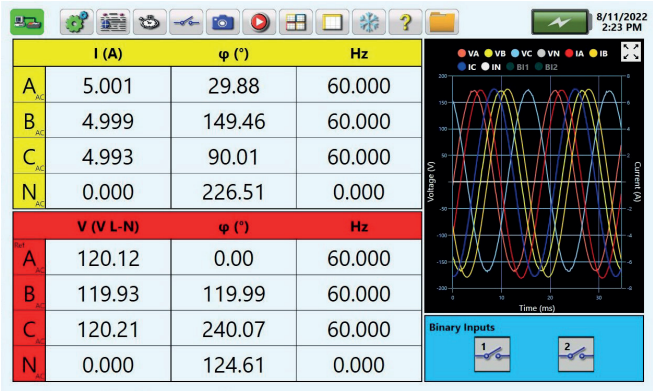

Figure 9: Main user interface screen with combined three phase waveforms

Display graphics are selected by the user. Quantities can be displayed as single-phase, two-phase or three-phase. The 4th channel can be added to the display as a neutral current. Figure 10 is showing a single-phase voltage and current using split screen, with waveforms only. This display does not include frequency, power, VA, or Power Factor. Alternatively, the user can select the display to include the phasor display showing the phase angle between the voltage and current being measured.

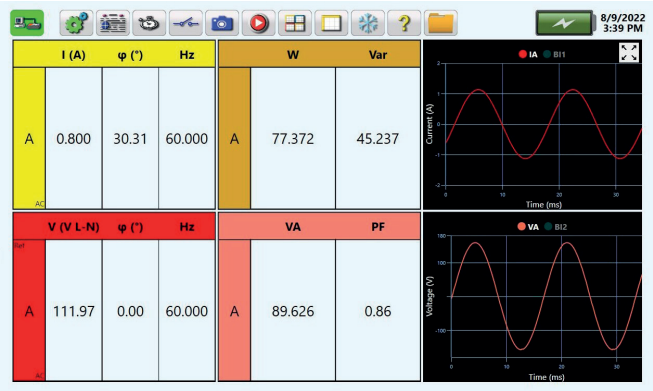

Figure 10: Split screen single phase waveforms

TIMING TEST FEATURE

Pressing the timer button (stopwatch icon) on the task bar, the user is presented with the timer configuration screen.

The timer configuration screen allows the user to set names for each timing event and set the start and stop conditions. The event can be set as a single shot, accumulate multiple timing event or a sequence event. Trip times can be displayed in seconds, milliseconds, or cycles, see Figure 11.

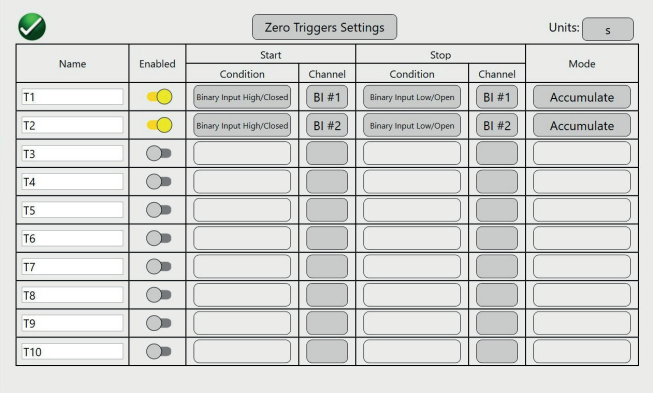

Figure 11: Timer configuration setting screen

The binary input configuration button (the open contact icon next to the stopwatch), allows the user to easily define each binary input type. In the menu the user can select a programmable threshold voltage, recorder trigger condition, debounce time, and have the unit sound a horn when the input condition is true, see the example in Figure 12.

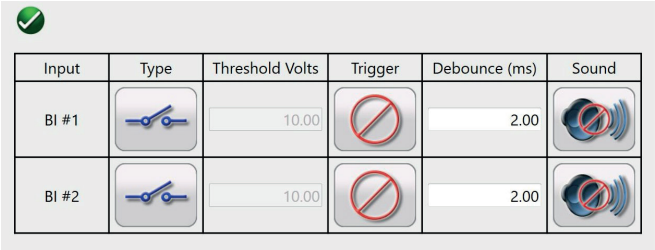

Figure 12: Binary input configuration

VIEW REPORTS

Press the view report button (next to the stopwatch icon) for a list of custom reports. Several types of example test reports have been created and are accessible in the menu. The user has the option to create and customise their own report. are different reports built in, or the customer can customise their own report. The report can be saved and exported for record keeping and/or NERC audits. See the example of UserReport4 in Figure 13.

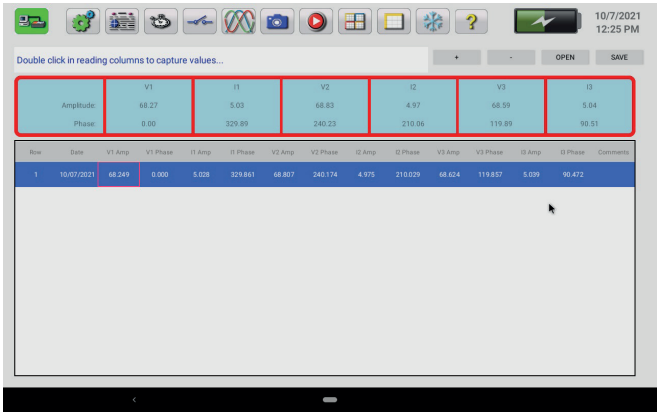

Figure 13: Example report

FEATURES AND BENEFITS

Large Color TFT LCD touchscreen display with user-friendly software and easy to read interface even in direct sunlight. The touch-display provides the user with manual control of the PMM-2. Color contrasts accentuate vital information, reducing human error and testing time.

Battery and line operated, with an automatic, built-in charger.

Rugged, ergonomic, and lightweight plastic enclosure.

Four isolated voltage and current channels with a built-in timer. The 4th channels may be used to measure the neutral current and a polarizing or synchronizing voltage.

The four voltage channels can be used to measure current by enabling the external CT option in the voltage channels settings.

Simultaneously measures and displays voltage, current, phase angle, power, reactive power, power factor, and frequency of single-phase, two-phase, or three-phase systems.

Measure phase-to-phase voltage and single-phase currents for checking of revenue meter installations.

Wide current and voltage operating ranges, including low-level voltage inputs from clamp-on CTs.

High-speed measurements and extended internal non-volatile memory to record up to 600 seconds of data.

Accurate phase angle measurements at low current levels.

Measurement and display of primary currents using clamp-on CTs.

Ability to input any current transformer ratio up to a ratio of 9999:1 or 9999:5.

Motor starting currents, voltages, and power can be captured for analysis.

Measures all harmonic content simultaneously of all selected voltages or currents, up to the 50th harmonic.

Internal memory provides storage of meter set-up screens and reports, which reduces testing time and paperwork.

SPECIFICATION[1]

Input power
90 to 253 V AC, 1Ø, 50/60 Hz, 150 VA.

Battery
Rechargeable Lithium-ION battery with internal automatic charger. Safety features include internal battery overcharging and charge exhaustion protection. Battery energy is limited to 97.2 Watt-hour (to carry on-board a commercial airliner the battery energy must not exceed 100 Watt-hour). The battery is RoHS compliant.

Operation time
± 4 hours continuous on full charge – actual operation time limited to 97.2 Watt-hour battery.

Voltage
0 - 1000 V (AC/DC)
4 Independent isolated inputs
Isolation voltage: 1200 V
Resolution: 0.000 V – 99.999 V
100.00 V – 999.99 V
1,000.0 V

Accuracy[2]:
AC/DC Volts

Ranges	**Accuracy**
0 - 299.999 V:	± 0.05 % of reading ± 40 mV
300 – 1000.00 V:	± 0.05 % of reading ± 65 mV

Input impedance:
0 – 34.999 V, 100 kΩ
35 V – 1 kV, 5 MΩ
Measured: RMS or AVG
Crest Factor: 3 or maximum 1450 V_{pk}

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Current
4 Total isolated inputs
3 Independent isolated inputs
0 - 100 A (AC/DC)
Isolation voltage: 300 V
1 Independent isolated input
0 - 32 A (AC/DC)
Isolation voltage: 300 V
Resolution: 0.000 mA – 99.999 mA
0.100 A – 9.999 A
10.000 A – 99.999 A and 100.00 A (Channel 1 – 3)
10.000 A – 32.000 A (Channel 4)
Minimum current measurement: 2 mA
Burden at 5 A: ≤ 0.1 VA
Crest factor: 3 or maximum 145 A peak, Channels 1-3, or maximum 46 A peak Channel 4

Accuracy[2] channels 1 – 4:
AC/DC current:

Ranges	Accuracy
0 – 0.999999 A	± 0.05 % of reading ± 2 mA,
1 – 9.99999 A	± 0.05 % of reading ± 10 mA,
10 – 32.0000 A	± 0.1 % of reading ±10 mA, Channel 4
32 – 100 A	± 1 % of reading Ch. 1 – 3

CT inputs (low level inputs):
Each current channel can be selected for low level input from clamp on CT's. CT secondary current and/or CT primary current scaling can be entered and automatically calculated for display.
4 Total isolated inputs
0 – 1 V (AC/DC)
Isolation voltage: 50 V AC
Resolution: 0.000 V - 1.000 V
Accuracy[2]: ± 0.05 % of reading ± 25 mV ± CT Accuracy

Phase Angle
0 - 360.00° lead or lag or ± 0 - 180.00°, 0.01° resolution
Accuracy[2]: ± 0.08° input levels above 30 V and 1.0 A (using current as reference), ± 0.5° input levels below 30 V and above 3 V and 0.02 A, ± 2° input levels down to 0.002 A.

Power
± 0 - 100 KW, 0.1% resolution.
Accuracy[2]: ± 0.2% of VA.

Reactive Power
± 0 - 100 KVAR, 0.1% resolution
Accuracy[2]: ± 0.2% of VA.

Power Factor
± 1.00 PF
Accuracy[2]: 0.01 PF

Frequency
Resolution: 10 - 1000 Hz, 0.001 Hz
Accuracy[3]: ± 4 ppm (0.0004 %) of reading

Harmonics
Measures all harmonic content simultaneously of any selected voltage or current, up to the 50th harmonic.
Accuracy[2]: ± 5% of total RMS ± 10 mA or ± 40 mV
Time:
Resolution:
Seconds: 0.0000 to 9.9999 – 5 digits
Greater than 10.0000 – 6 digits
Cycles: 5 digits or maximum 0.1 cycle

Seconds mode
200 µs or ± 0.005 % of reading, whichever is greater when initiated by a dry contact, a DC potential above 5 V or an AC potential above 115 V AC*.

Cycles mode
± 0.5 cycle when initiated by a dry contact, a DC potential above 5 V or an AC potential above 115 V AC*.
*AC voltage accuracy is worse at lower voltages and is ± 8 ms in worst case (5 V rms applied just following wave-shape peak).

Start/stop inputs
5-300 V (AC or DC) start or stop inputs. AC or DC applied/removed, or dry contact closure or opening.

Voltage applied
Timers start or stop when an AC or DC potential (5 to 300 V) is applied.

Voltage removed
Timers start or stop when an AC or DC potential (5 to 300 V) is removed.

Input resistance
1000 Ω min.

Data Input/Output
Ethernet: There are two Ethernet ports. **IN Port** – Primary PC connection Port. **OUT Port** – For future use.
USB Type A Ports – Two ports available. These ports are used to update the firmware and software in the system.
USB Type B Port – This interface requires a Type B "downstream" connector and is a communication and control port when used with a PC and Megger software.

Display screen
The display provides high resolution and features a wide viewing angle technology and a large screen with high luminance.
Dimensions: 8.5 H X 5.3 W inches (215.9 H X 134.6 W mm), 10.1 inches Diagonal (256.5 mm)
Display: 262k Colors, backlit, 800:1 contrast ratio, projected capacitive multi touch screen, 700 nits panel brightness, 1280 x 800 resolution
Languages: English, French, Spanish and German

Unit dimensions
PMM-2: 13.5 W x 9 H x 6 D inches - 342.9 W x 228.6 H 152.4 D mm
PMM-2R: 18 W X 9.5H X 13.5 D inches – 457.2 W x 241.3 H x 342.9 D mm

Weight
PMM-2: 13.4 lb. (6.0 kg)
PMM-2R: 17 lb. (7.7 kg)

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Operating temperature
-15° to 55° C (5° to 131° F)

Storage temperature
-30° to 75° C (-22° to 167° F)

Ingress protection
IP 20

Conformance standards
Safety: EN 61010-1, overvoltage category 600V Cat IV, 1000 V Cat III
Shock: EN/IEC 60068-2-27
Vibration: EN/IEC 60068-2-6
Transit drop: ISTA 1A
Free fall: EN/IEC 60068-2-32
Drop/topple: EN/IEC 60068-2-31
Electromagnetic compatibility
Emissions: EN 61326-2-1, EN 61000-3-2/3, FCC Subpart B of Part 15 Class A
Immunity: EN 61000-4-2/3/4/5/6/8/11

[1] Megger reserves the right to change product specifications at any time.
[2] Accuracies specified within 23° ± 5° C (73° ± 9° F) in the frequency range of 45 to 65 Hz, and after warm-up of 20 min.
[3] Accuracies specified within 23° ± 5° C (73° ± 9° F), and after warm-up of 20 min.

MODEL ORDERING INFORMATION

DESCRIPTION	PART NUMBER
Standard Power Multimeter with the 100A current terminals and an American power cord.	**PMM-2-100A-A**
Standard Power Multimeter with the 100A current terminals and an international power cord.	**PMM-2-100A-I**
Standard Power Multimeter with the 100A current terminals and a Continental Europe power cord.	**PMM-2-100A-E**
Standard Power Multimeter with the 100A current terminals and a United Kingdom power cord.	**PMM-2-100A-U**
Rugged Power Multimeter with the 100A current terminals and an American power cord.	**PMM-2R-100A-A**
Rugged Power Multimeter with the 100A current terminals and an international power cord.	**PMM-2R-100A-I**
Rugged Power Multimeter with the 100A current terminals and a Continental Europe power cord.	**PMM-2R-100A-E**
Rugged Power Multimeter with the 100A current terminals and a United Kingdom power cord.	**PMM-2R-100A-U**

Descriptions of power cord options
The following are detailed descriptions of each power cord option.

- **(A) North American power** cord – NEMA 5-15 to IEC60320 C13 connectors, UL and CSA approved for countries with NEMA outlets.
- **(I) International** power cord – International color-coded wires (light blue, brown and green with yellow stripe) insulation jacket stripped ready for male connector with IEC 60320 C13 connector. CE marked.
- **(E) Continental Europe** power cord – CEE 7/7 "Schuko" plug to IEC 60320 C13 connector is CE marked.
- **(U) United Kingdom** power cord – Power cord with IEC 60320 C13 connector, and 13 A fuse. BS 1363/CE Marked.

TEST LEADS AND ACCESSORIES

All PMM-2 units are supplied with a power cord defined as per the model ordering information, and an Ethernet communication cable.

Included standard accessories		Part number
Power Cord - Depending on the style number, the unit will be supplied with one of the following:		
Line cord, North American		**6828**
Line cord, Continental Europe with CEE 7/7 Schuko Plug		**90015-268**
Line cord, International color-coded wire		**90015-269**
Line cord, United Kingdom		**90015-270**
Ethernet cable for interconnection to PC, 210cm (7 ft.) long (Qty. 1 ea.)		**90003-684**
Instruction manual USB memory stick		**87865**
	**Soft sided carry case:** The soft-sided carry case protects the unit from light rain and dust. The padded sides provide moderate protection while in transit. Pouch provides storage of power cord, test leads, and accessories. (Qty 1). Not provided with PMM-2R models.	**2014-768**

TABLE OF OPTIONAL TEST LEADS AND ACCESSORIES

	Descriptions of optional test leads and accessories	Part number
	**Color-coded, sleeved test leads:** Sleeved test leads, one red, one black, 200 cm (78.7") long, 600 V, 32 A CAT II RoHS compliant.	**2008-539-2**
	**Color-coded, sleeved combination voltage test leads:** Sleeved, color coded 6 x 4 test lead, 200 cm (78.7") long, 600 V, 32 A CAT II* RoHS compliant.	**2008-540-2**
	**Color-coded, sleeved combination current test leads:** Sleeved, color coded 6 x 6, 200 cm (78.7") long, 600 V, 32 A CAT II* RoHS compliant.	**2008-541-2**
	**Cable/spade lug adapter (small):** Small lug to fit most small terminal blocks. Lug adapter, **red**, 4.1 mm, rated up to 1000 V/20 A CAT II	**684004**
	**Cable/spade lug adapter (small):** Small lug to fit most small terminal blocks. Lug adapter, **black**, 4.1 mm, rated up to 1000 V/20 A CAT II	**684005**
	**Extra-long test lead: Black**, use with voltage/current inputs, or binary I/O, 360 cm long (12 ft) 600 V/ 32 A CAT II.	**2003-172**
	Extra-long test lead: Red, use with voltage/current inputs, or binary I/O, 360 cm long (12 ft) 600 V/ 32 A CAT II.	**2003-173**
	**Alligator/crocodile clip:** Excellent for test connections to terminal screws and pins where spade lugs cannot be used.	
	Red, use with test leads up to 1000 V/32 A CAT III.	**684006**
	Black, use with test leads up to 1000 V/32 A CAT III.	**684007**
	**Fused test clip: Black** with 20 mm steel jaws, 1000 V AC/DC, CAT III, (fuse not included).	**90022-982**
	Fused test clip: Red with 20 mm steel jaws, 1000 V AC/DC, CAT III, (fuse not included).	**90022-983**
	Fused test clip: Blue with 20 mm steel jaws, 1000 V AC/DC, CAT III, (fuse not included).	**90022-984**
	Fused test clip: Yellow with 20 mm steel jaws, 1000 V AC/DC, CAT III, (fuse not included).	**90022-985**
	Digital Multi-meter Fuse: 1 each, Fast Acting, 11 A, 1000 V AC/DC. Note that each test clip will require 1 each of the fuse.	**90026-411**
	**Cable/spade lug adapter (large):** Large spade lug fits older relay terminal blocks, or STATES Company FTP10 or FTP14 test paddles, ABB, or General Electric test plugs with screw down terminals.	
	Lug adapter **red**, 6.2 mm, use with test leads up to 1000 V/20 A CAT II.	**684002**
	Lug adapter **Black**, 6.2 mm, use with test leads up to 1000 V/20 A CAT II.	**684003**
	Flexible test lead adapter: Use with rail-mounted terminals or screw clamp connections where spade lugs and crocodile/alligator clips cannot be used. Flexible test lead adapter, **black**, 1.8 mm male pin, use with test leads up to 1000 V CAT III /32 A.	**90001-845**
	**Jumper lead:** Used to common neutral returns together Jumper lead, **black**, 12.5 cm (5") long, use with voltage and current neutral returns, 600 V, 32 A, CAT II.	**2001-573**
	**Flexible test lead adapter with retractable insulated sleeve:** Retractable sleeve test lead, **red**, 50 cm (20") long, use with test leads up to 600 V/32 A CAT II.	**90024-780**
	Flexible test lead adapter with retractable insulated sleeve: Retractable sleeve test lead, **black**, 50 cm (20") long, use with test leads up to 600 V/32 A CAT II.	**90024-781**

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Current leads with STATES I-Probe:
The measurement of secondary current from a distribution test switch can be obtained by using the 20 A STATES current plug.

One STATES current plug, 3 ft. 6 in. (1m)

1014-727

Clamp-on AC current probe:
The clamp-on current probe makes it easy to check current path in a wired distribution panel without worry of interrupting a current circuit in service.

Nominal range: 5 A, 100 A
Measurement range: 5 A: 0.005 to 6 A
100 A: 0.1 to 120 A
Transformation ratio: Voltage output
Output Signal: 5 A: 200 mV/A
100 A: 10 mV/A
Accuracy:

5 A range:				
Ip	0.005 A	0.05 A	0.5 A	5 A
Vs%	1.5% +0.02mV	1.5%	1%	1%

100 A range:				
Ip	0.1 A	1 A	10 A	100 A
Vs%	1% +0.02mV	1%	1%	1%

Dimensions: 5.47 H x 2.00 W x 1.18 D in.
139 H x 51 W x 30 D mm
Weight: 6.5 oz (180g)

1014-723

Clamp-on AC/DC current probe:
The AC/DC current probe is designed for AC/DC current measurement capabilities using "Hall Effect" technology. The unique design is made for probing in crowded wiring environments.

Nominal range: 10 A and 100 A
Measurement range: 100 mA to 100 A
Transformation ratio: Voltage output
Output signal: 10 A: 100 mV/A
100 A: 10 mV/A
Accuracy:
50 mA to 10 A peak: 3 % of reading ± 50 mA
500 mA to 40 A peak: ± 4 % of Reading ± 50 mA
40 A to 100 A peak: ± 15% max at 100 A
Output termination: 6.5 ft (198 cm) coaxial cable
Dimensions: 9.09 H x 1.42 W x 2.64 D in. (231 H x 36 W x 67 D mm)
Weight: 11.6 oz (330 g) with battery

1014-721

AC current probe:
The measurement of primary current can be measured by using the optional clamp-on current probe. The high accuracy voltage output current probe is made for tight spaces such as crowded wiring.

Current range: 1 mA to 10 A AC, continuous
Output signal: 100 mV AC/A, 1 V at 10 A
Accuracy class: 1 mA to 10 A: 2 % ± 2 mA

Maximum cable diameter: 0.47 in. max (12 mm)
Dimensions: 1.26 x 4.5 x 0.87 in. (32 x 115 x 22 mm)
Weight: 6 oz (160 g)

1014-722

Accessory Pack:
(1) 6 x 4 Voltage leads - Part number: 2008-540-2
(4) 10 Amp current probe - Part number: 1014-722
(6) Red clip - Part number: 684006
(6) Black clip - Part number: 684007
(1) Lead bag - Part number: 2003-725

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